Norwegian salmonid farming

A short discussion on sustainability, responsibility and animal welfare

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Intensive animal production

Sustainable production

- Social
- Environmental
- Economic

Responsible production

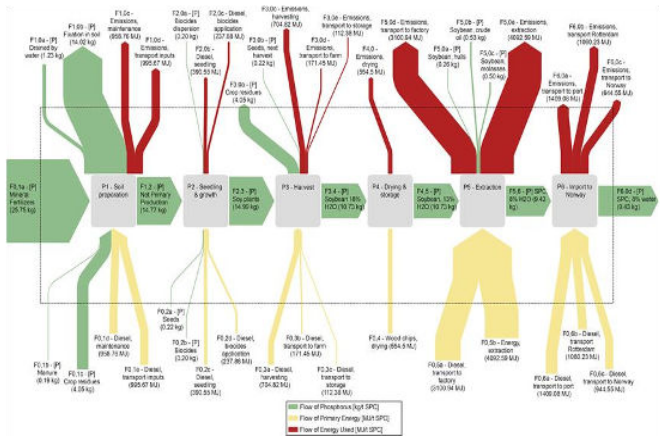
- Welfare
- Health
- …

Intensive animal production

Sustainable production

- Social
- Environmental
- Economic

Methods for comparisons, analyses and decision support.

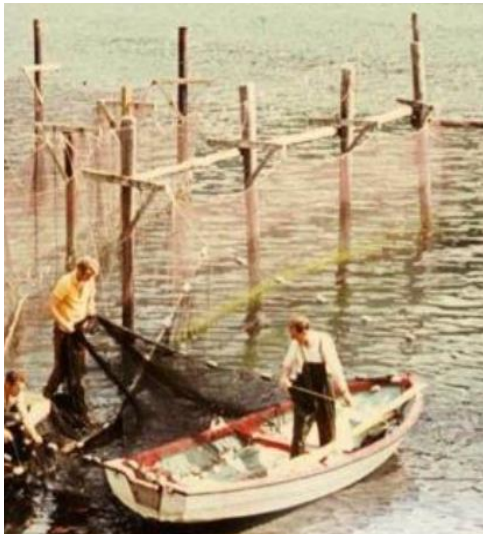


- Emissions
- Cost
- Workforce
- …
- Data
- Environment
- Responsibility

Responsible production

- Welfare
- Health
- …

An industry growing up




Quick growth of the industry gives possibilities and challenges.

Farming becomes complex.

Four areas in this talk

Examples from four areas not easily covered by LCA and similar analyes:

Fish welfare

Salmon lice

Diseases and medication

Eutrophication

Welfare

What is good welfare?

«Quality of life as perceived by the animal itself» (Stien et al., 2013; Fishwell)

Difficult to express in «numbers»

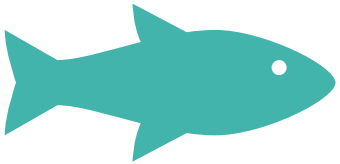
Many different definitions have been proposed

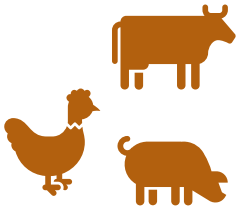
Standards and regulations exist

National, but also others like RSPCA (Royal Society for the Prevention of Cruelty to Animals) welfare standard for farmed Atlantic salmon

Welfare

What is good welfare?





Five freedoms (1979):

- Freedom from hunger and thirst
- Freedom from discomfort
- Freedom from pain, injury or disease
- Freedom to express (most) normal behaviour
- Freedom from fear and distress

Welfare

How to measure welfare?

- On-site
- Lab

- Individual
- Group

- External
- «Internal»

- Environmental

Welfare

What do we know?

- Mostly good conditions (see also 5 freedoms)
- Little handling
- Relatively good control

- Biological challenges
  environment interactions, behavior, +++
- Mortality (15 % of individuals)
  - Mostly small fish
- Impact on other organisms?

Welfare

What is done?

Research
Industry, Research council, R&D licenses, +++

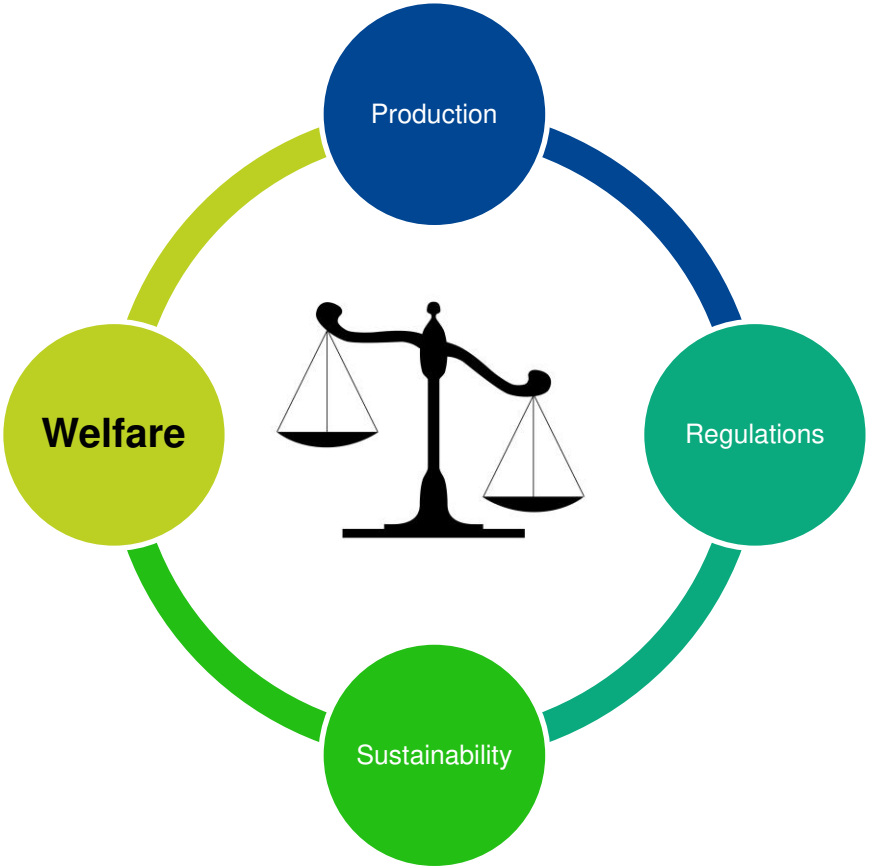
Regulations and control by public administration

Fish farmers
Routines, Education, attitude building, +++

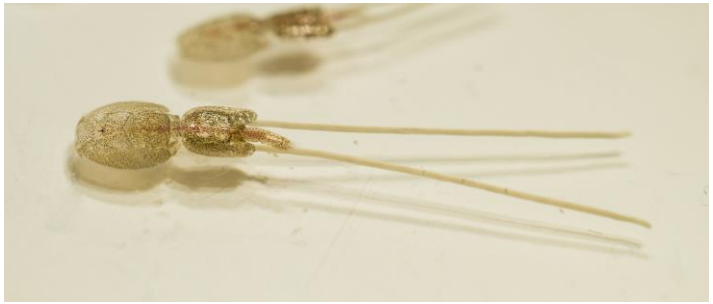
Industry and suppliers
Development to meet demands, also within welfare

Welfare

Example: salmon lice



Salmon lice



What are salmon lice?

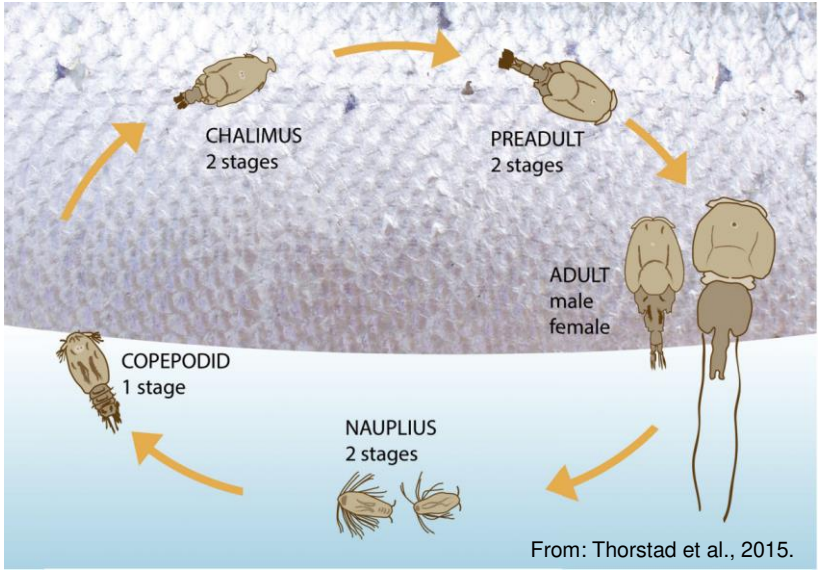
Ectoparasite with natural occurance.

Can be a threat in large numbers, and can cause secondary problems.

Salmon lice

What are salmon lice?

What is the problem?

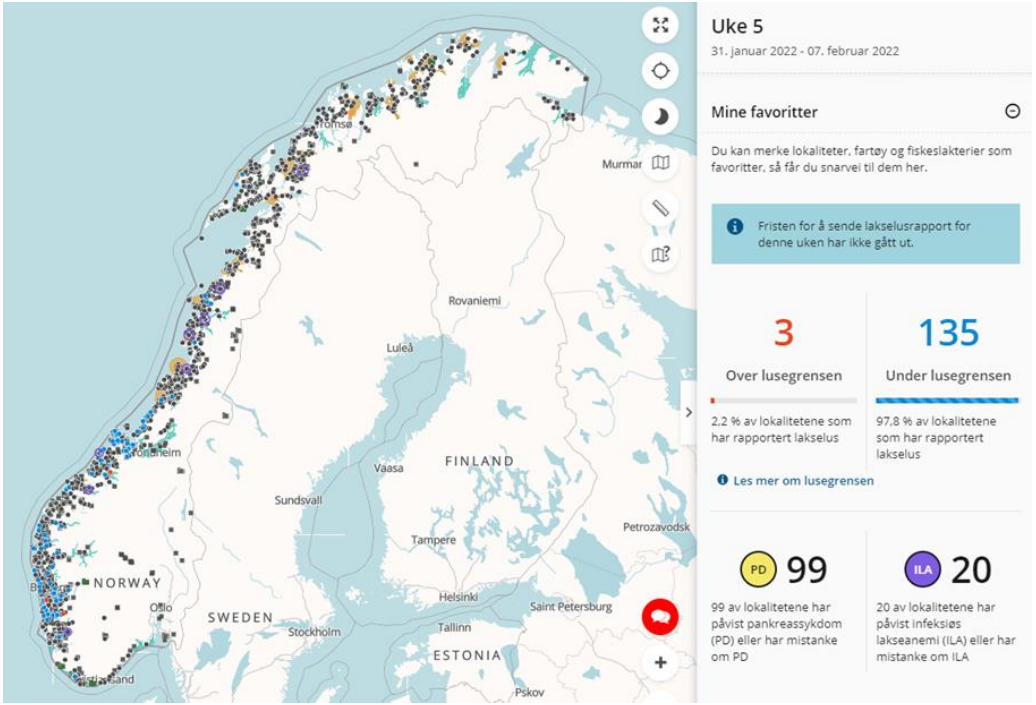


Large amounts of farmed salmonids means many hosts in the ecosystem.

Threat of endangering wild fish.

Salmon lice

What is the situation?



Lice situation partly defines if growth is allowed.

Salmon lice

What is done?

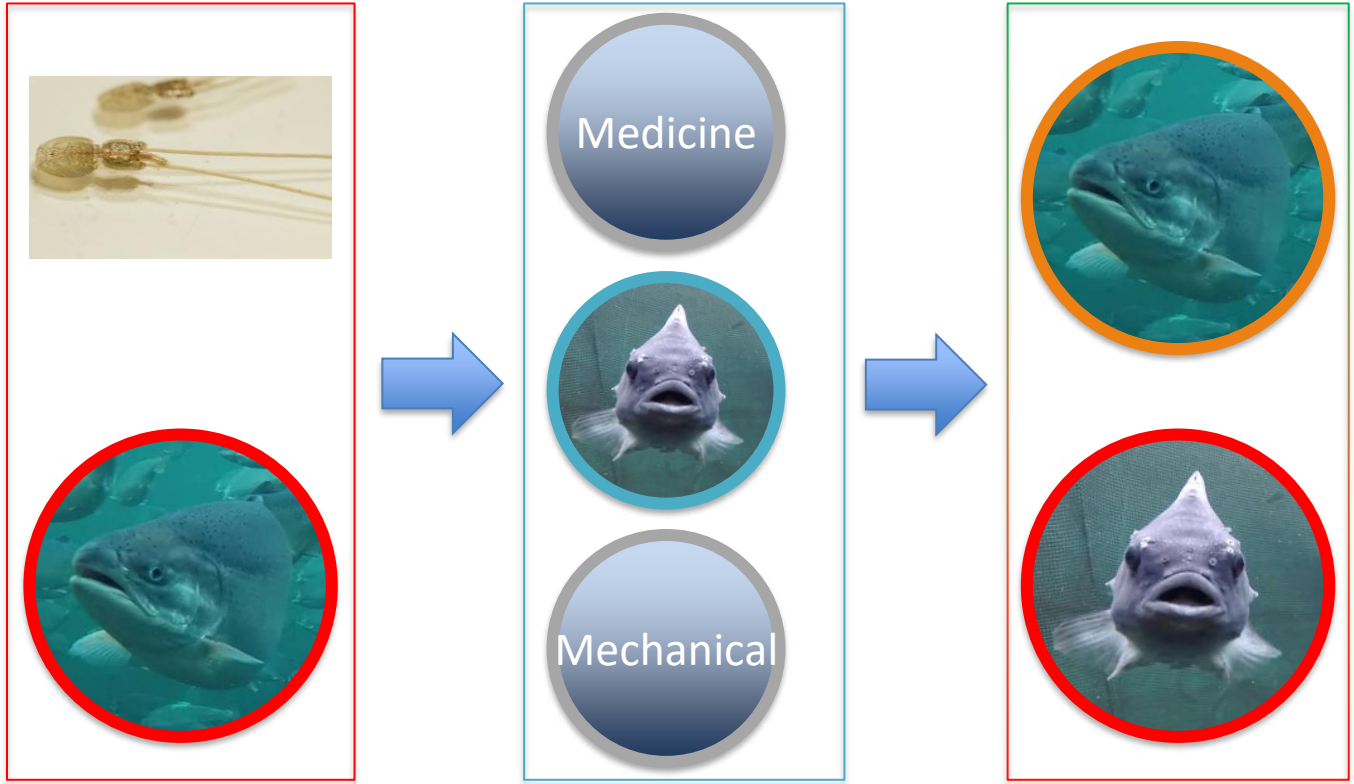
- Regulations for operation
- Development of industry depends on biological situation

- Prevention
- Treatment and removal

- Production planning
- Training and follow-up

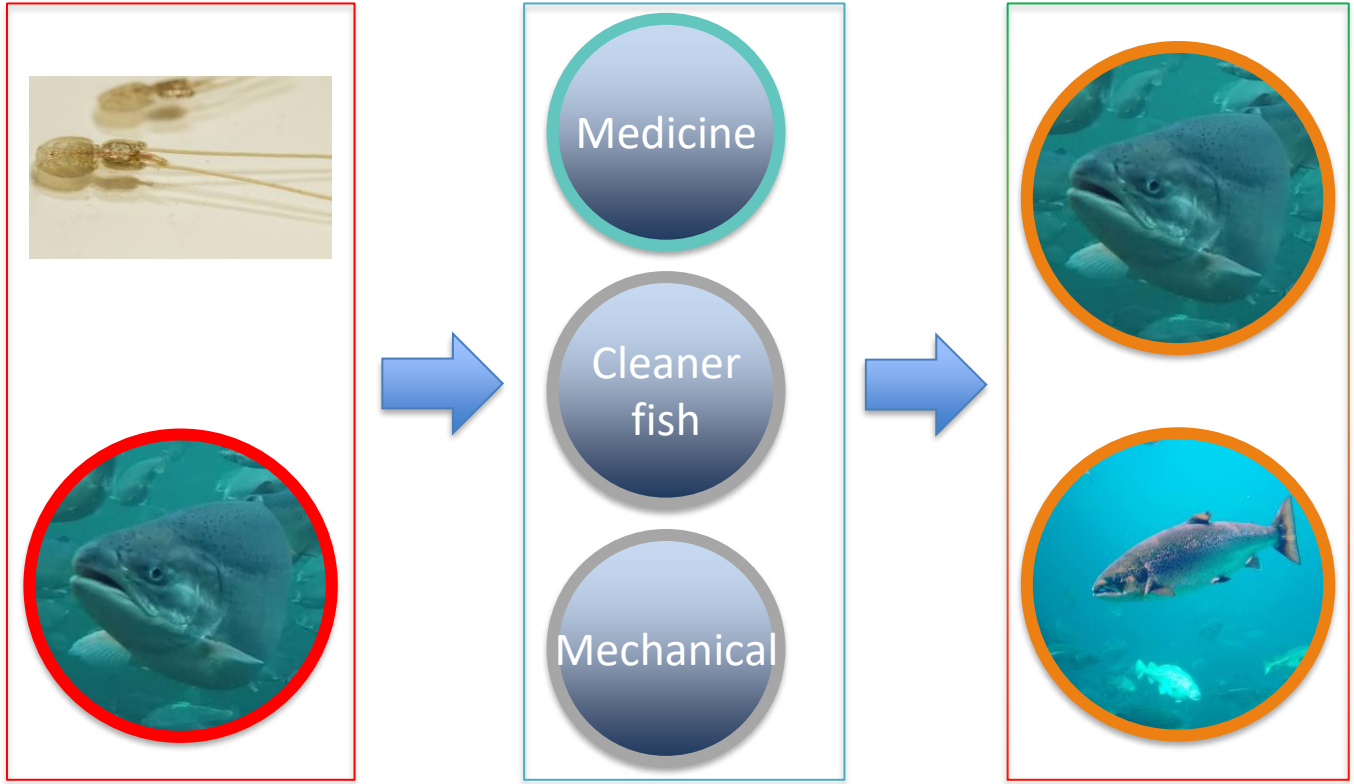
Salmon lice

Balance



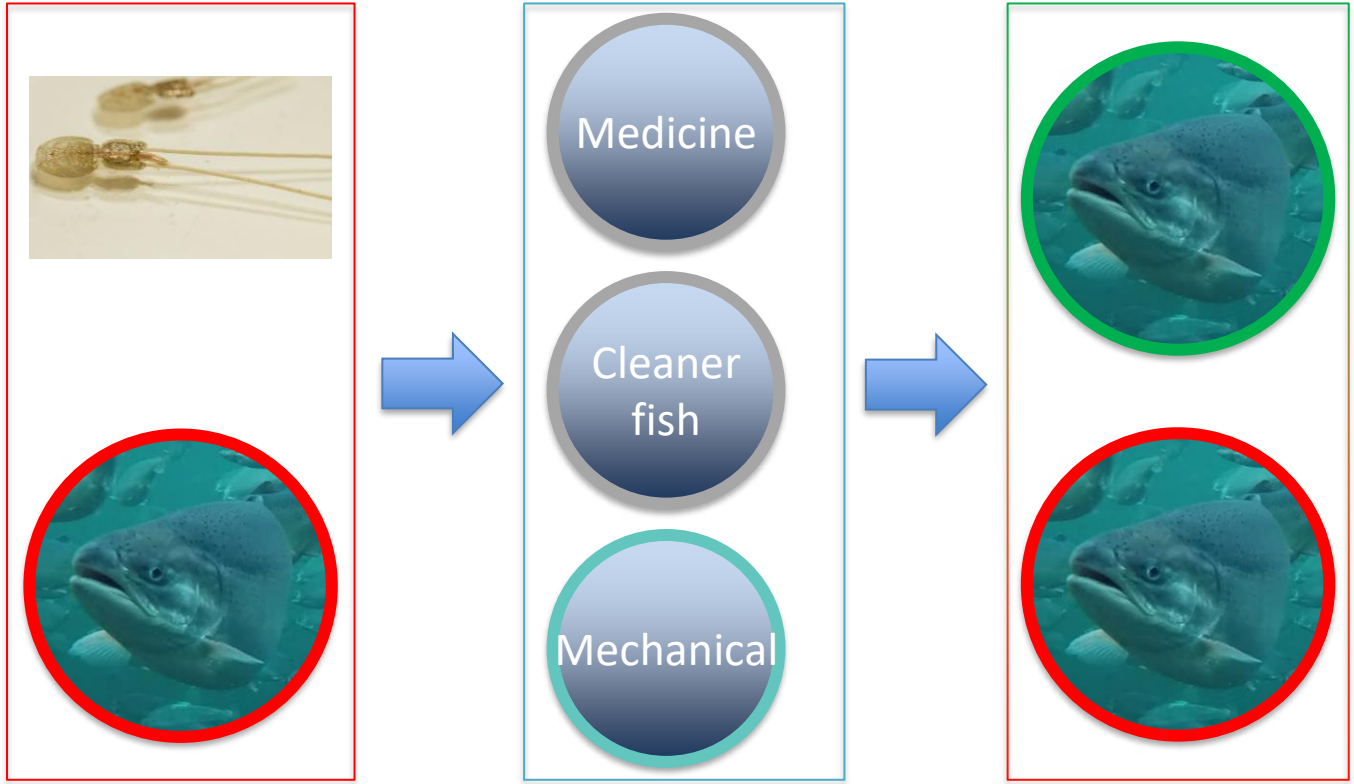
Salmon lice

Balance



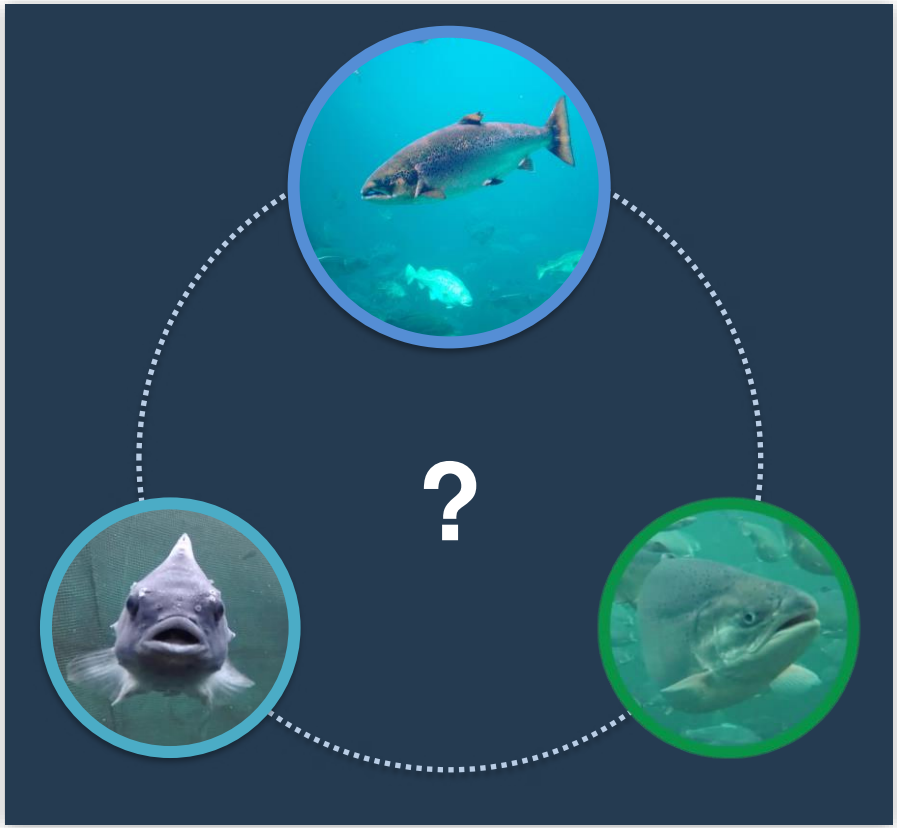
Salmon lice

Balance



Salmon lice

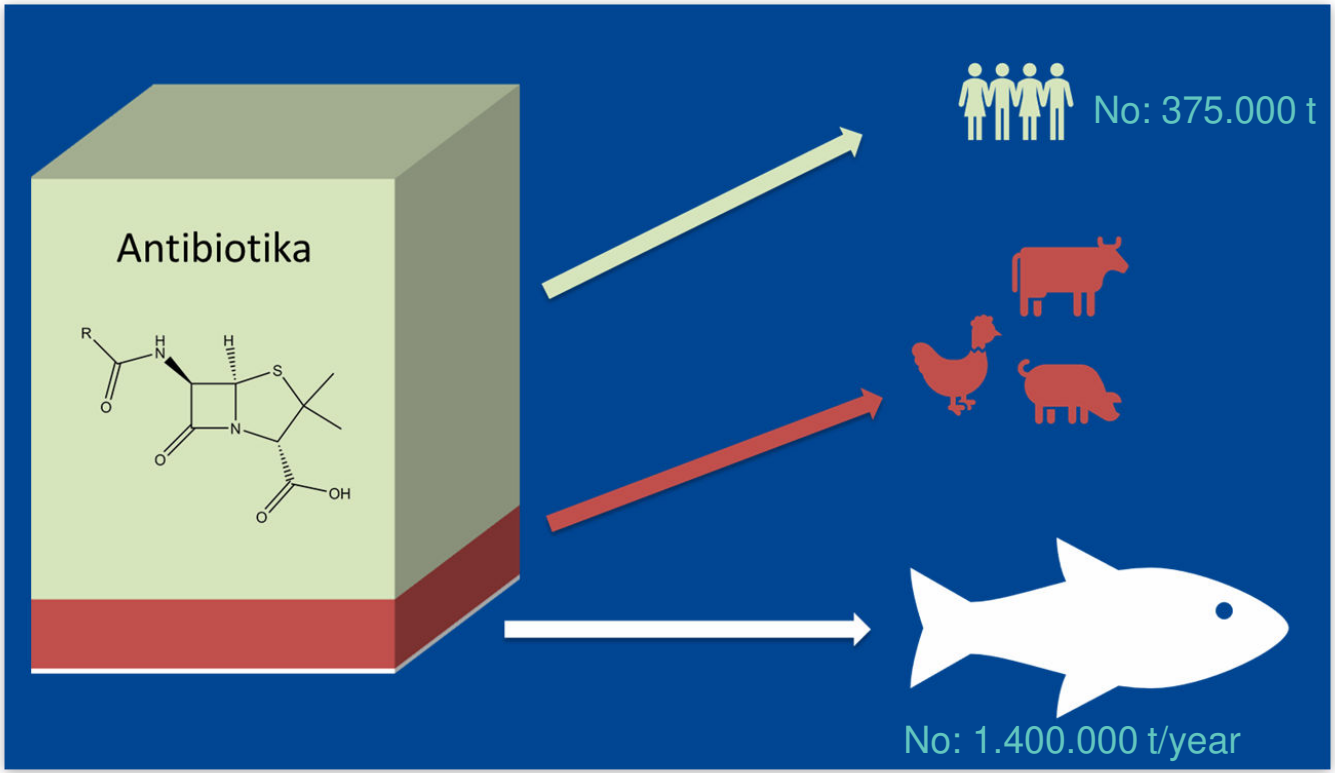
Balance



Diseases and medication

- A range of diseases and parasites affect farmed salmonids
- Much effort is on prevention
  - Breeding for resitance
  - Vaccines
  - Operations and management
  - …
- Treatment by feed or adjustment of operations
- Relatively litte use of medication

Diseases and medication



Very little use of antibiotics.

Eutrophication

What is the waste output from a salmon farm in the sea?

Feed conversion ratio: 1.2

Dissolved Nutrients

Large output of nitrogen an phosphorous

Particles

1-5 % of feed remains uneaten (up to 84.000 t)

25 % of feed intake excreted (420.000 t)

Eutrophication

What is the fate of nutrients From aquaculture sites?

Eutrophication

What is the fate of nutrients From aquaculture sites?

- **Dissolved nutrients:**

  direct effects on the ecosystem are not easily measured

- **Particles:**

  Wild animals may eat particles

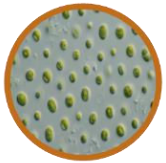
  Accumulation on te bottom is possible.
  Depends on dept, currents, etc.

Eutrophication

Is this a problem?

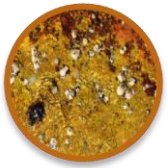
Wild fish – water column

Aggregations, changes in survival, behavior, etc.



Other wild organisms – water column

Take up nutrients, change in species composition?



Sea floor

Sedimentation possible, change in sediments and species composition

Ecosystem

Mostly no large impacts, but local impacts possible

Eutrophication

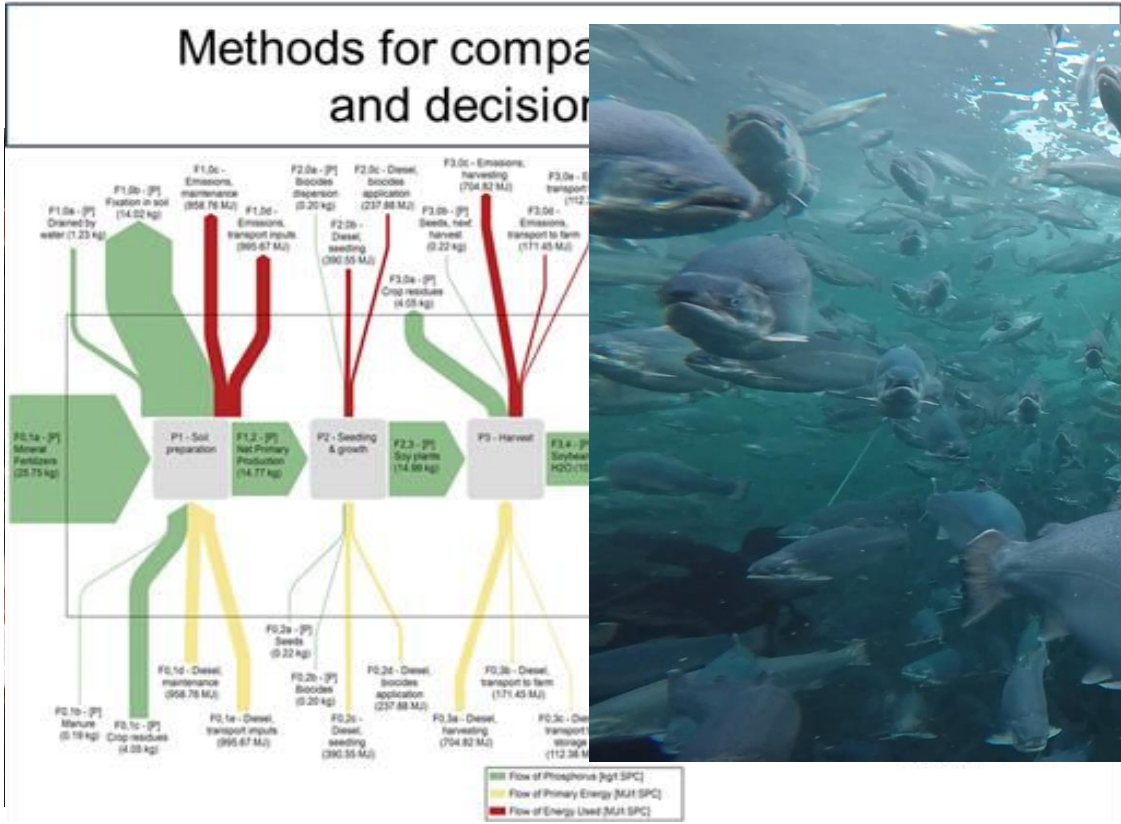
What is done?

- Regulations for operation
- Fallow periods until «zero impact»

- Improved feed and feeding
- Alternative production units

- Production planning, area planning
- New systems and training

Trade-off in production



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Conclusions?

Even though there are many challenges, salmon production does well in comparisons.

Does that mean it is sustainable or ethical?

Conclusions?

Trade-offs

What is important to you?